ENGS 27
Final Project: Noisy Channels

Professor Bijan Mazaheri

Summary, 2025

Assigned: Friday, August 15th

Code Due: Saturday, August 30th
Write-Up Due: Tuesday, September 2nd

1 Group Project ($\leqslant$ 50 points)

You are given a noisy channel (starter code) that receives a string of bits and makes errors according to an unknown mechanism. Your task is as follows:

1. Analyze the behavior of the channel using probabilistic concepts from this class. Determine the source and behavior of the noise.

2. Design an encoding that compresses English messages and adds redundancy for error correction. You will also need to decide on the size of your packets if you choose to use Hamming codes for error correction.

3. Implement your encoder and decoder. You may want to use concepts from DFAs or a decision tree (which is similar), or adjacency matrices. The implementation details are up to you!

Projects will be evaluated based on:

- **Efficiency**: Please try to use as few bits to encode a message as possible.

- **Accuracy**: Please try to make as few errors as possible in the decoded message.

To receive a grade in the B range (40-45 points), you only need to create a working project: e.g., Huffman encoding that is protected using Hamming codes for some reasonable size. Performance will determine where you fall in this range.

To receive a grade in the A range (45-50 points), you will need to add clever ideas of your own to improve either error-correction or compression. This will also give you more to write about in your write-up. Once again, performance will determine where you fall within this range.

I may give more credit to implementations that make lighter use of third-party Python packages. More advanced approaches that require many packages are still allowed, but you must demonstrate your understanding of these packages in your write-up.

Please turn in all of your code. The use of AI is allowed, but **you must be able to explain all of the code that you turn in**, or your submission may be considered plagiarism.

2 Individual Writeup (⩾ 50 points)

Each group member will produce an individual write-up of the project. Please limit your submission to three pages without references (it is a good exercise to try to write concisely). Your write-up should include:

- A list of your group members.

- An explanation of your approach and why you made the decisions you did. This may include an analysis of the channel. You may share plots across group members.

- A brief overview of what any imported functions from third-party libraries do.

- A summary of your contributions to the project. This may overlap with other group members' contributions.

- An (optional) discussion of other ideas you have but were unable to implement, or what you would want to try if given more time.

The target distribution between the individual write-up and group code is 50 points each. However, I reserve the right to make the individual write-up worth a larger percentage of your final project grade if there are significant disparities in the contributions of the group members.